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THE ADVISORY COMMITTEE ON BIOLOGY  
OF THE  
NATIONAL RESEARCH COUNCIL OF CANADA

has unanimously approved the report of the  
Sub-Committee formed to assess

Science Council of Canada Report No. 12

"Two Blades of Grass: The Challenge Facing Agriculture"

and Science Council Special Study No. 10

"Agriculture Science in Canada"

and is pleased to present it to the

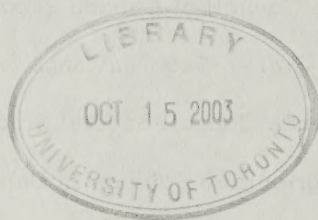
253rd Meeting of the

National Research Council of Canada

held at the University of British Columbia

Vancouver, B. C.

26 and 27 June 1973



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2-1 MAY 1973





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## INTRODUCTION AND GENERAL THRUST OF THE SCIENCE COUNCIL REPORTS

The sub-committee's task was to examine Science Council Special Study #10 (1) and Report #12 (2), to comment on their validity in relation to agricultural science and to suggest how the NRC should react to them. Although the reports, particularly Special Study #10, have now become to some extent out-moded by the progress of events, they embody a number of important conclusions or recommendations. Both reports reflect a central concern with the establishment of better methods of co-ordinating and funding agricultural research than those that exist at present. The sub-committee believes that it is in precisely these areas, especially in relation to the universities and to industry, that the NRC should provide active leadership.

The Science Council reports emphasize:

- 1) that, in the words of Report #12, "The main agricultural thrust and aim should be towards (the establishment of) (a) an economic and stable domestic food supply, (b) a maximum competitive position in international markets, consistent with the income and welfare of all stake-holders involved in the agricultural industry".
- 2) that agricultural research encompasses a blend of disciplines ranging from sociology and economics through several branches of pure and applied biology, physics and chemistry.
- 3) that the solution to many of Canada's agricultural problems can only be achieved through interdisciplinary effort.



4) that there has been an imbalance in Canadian agricultural research because the major emphasis has been placed on the biological aspects of production agriculture and too little effort directed to the socio-economic, engineering and marketing aspects.

5) that the performance of agricultural R & D has been primarily the responsibility of the federal government sector (CDA), and that the contribution of the industrial sector has been very small.

### THE CURRENT SITUATION

#### (1) CASCC's Role in Agricultural Research

The Canadian Agricultural Services Co-ordinating Committee is the only body which claims to co-ordinate agricultural research at the national level in Canada. According to a document prepared by CASCC, its primary objective is "to co-ordinate the total national effort toward the economic and social development of the agricultural industry and to promote the optimum utilization of manpower and financial resources within and between the various operational agencies". In spite of this statement CASCC does not in fact make inputs to the co-ordination of the inhouse research of the CDA. The latter has a highly effective system of internal planning and co-ordination which involves program co-ordinators, annual program reviews and the use of work-planning meetings, all under the guidance of an assistant director general for Planning and Co-ordination. Thus in 1971-72, CDA's Research Branch conducted nine work planning meetings on New Crops,



Rapeseed, Virology, Potatoes, Weeds, Nematodes, Beef System, Insect Control and Agrometeorology at eight different centres across Canada. Most, if not all, of these meetings have involved industry and university personnel and their opinions, thus providing a vehicle for the promotion of program co-ordination.

CASCC itself is chaired by the deputy minister of the CDA and uses the resources of the department as its secretariat. It consists of two sections: (1) The Deputy Ministers Section includes the 10 provincial deputy ministers of agriculture. This section has the responsibility for the co-ordination of policies and regulations, including those CASCC recommendations with policy implications. It really serves as a channel of communication between the federal department and the provincial departments. (2) The Research, Education and Extension Section is chaired by the Assistant Deputy Minister (Research) for CDA. Eight Deans of Agriculture are included in the membership of this section, which proposes recommendations on programs relating to research, education and extension.

Fourteen Canada Committees (e.g. the Canada Committee on Grain Breeding) report to CASCC. Several of these committees were formerly NRC Associate Committees. Membership on these committees is widely based, including personnel from CDA, universities, industry and provincial departments of agriculture. Nevertheless, CASCC is not in a position to co-ordinate university based research. Indeed the Research, Education and Extension Section has little or no influence at all on university





undergraduate and graduate programs in agriculture.

The only direct way in which CASCSC affects university operations is through its program of extramural contracts and operating research grants. The operating grants program has amounted to \$650,000 per annum for several years. The only change in recent years occurred in 1972/73 when \$100,000 of the total was used to provide 10 grants of \$10,000 each to be spent on research at the discretion of each of the 7 deans of agriculture and 3 deans of veterinary medicine. In 1972/73 146 scientists were supported at an average of \$3767 each. For the past two years CASCSC has directed its grants committee to give priority to projects in agricultural economics, agricultural engineering and pollution. It should be noted that NRC support of agricultural engineering has been less than adequate and that the NRC does not fund research in economics; the latter is supported by the Canada Council. It will be clear that any attempt by CASCSC to channel or co-ordinate university research through its program of operating grants is unlikely to be successful because of the low level of support provided to each project.

The extra-mural research program has amounted to \$150,000 per annum for the past several years. For 1972/73 25 contracts at 13 universities were funded at an average level of \$6,000 per annum. In theory EMR contracts are selected by CDA in areas of agricultural research considered to be urgently required to complement existing CDA programs. These contracts undoubtedly provide a measure of CDA-university co-operation. Nevertheless,



the over-riding fact is that, through no fault of the personnel involved, the entire CASCC grants program is totally inadequate to achieve CASCC's stated objective of co-ordinating "the total national effort" in agriculture. The small amounts of money provided by CASCC are a relatively small proportion of the total support for university research in agriculture, and accounts for only 2 to 10% of any agricultural faculty's total research budget. Indeed for most faculties of agriculture the percentage must be much lower than 10%. It is also important to note that CASCC, unlike the NRC, funds very little research in university faculties other than agriculture. Thus only about 6 grants were made to university scientists in science faculties in 1972.

Finally, CASCC has no programs designed to stimulate agricultural R & D by industry or to provide direct scholarship support for graduate students or postdoctoral fellows.

## (2) The NRC's Role in Agricultural Research

The influence of the NRC on agricultural research in Canada has already been reviewed in some detail (4). The following key points stand out:

- (i) According to the NRC Act, the NRC still has a legal responsibility for "researches to assist agriculture".
- (ii) The NRC has developed an industrial research program which includes support for the food and pesticide industries.
- (iii) NRC is the major source of federal funds for university based research in agriculture, through





- (a) the negotiated grants program
- (b) contracts awarded through the Associate Committee on Scientific Criteria for Environmental Quality
- (c) the operating grants program
- (d) the graduate student support program.

- (iv) At the present time, having recently transferred 4 associate committees to CASCC (now the Canada Committees on Grain Breeding, Grain Diseases, Grain Quality and Animal Nutrition) the NRC has no associate committees directly concerned with agriculture.
- (v) The NRC also conducts, in its own laboratories, research directly related to agriculture. Important work on seaweed agriculture and on the cause of poor growth of livestock on pastures is conducted at the Atlantic Regional Laboratory in Halifax; the Division of Biological Sciences in Ottawa has an extensive program of research in food biology, investigating problems related to food processing, handling and storage and the disposal of food plant wastes; the Prairie Regional Laboratory at Saskatoon has played an important part in collaboration with CDA and the University of Saskatchewan in developing rapeseed as an alternative commercial crop, and is now collaborating in work on the utilization of field peas as a source of protein. It also has programs of research on nitrogen fixation, plant cell culture and the physiology of root rot control. These programs have been concisely summarized by Simpson (5).



Negotiated grants are awarded through the Committee on Grants and Scholarships after review of the proposed project by a small committee which visits and interviews the group applying for support. Only 3 such grants have been made for the support of agricultural research (cereal grain quality at Manitoba; crop development centre at Saskatoon, agricultural engineering at Saskatoon), but in each case the level of funding (circa. \$100,000 per year for 3 years) has been sufficient to permit the development of a significant research program in a specific area, a feat which CASC has never been able to accomplish. Similarly, with one contract for \$160,000 over a 3 year period for work on the effects of air pollution on plants, awarded to a group in the Faculty of Agricultural Sciences at U.B.C., the NRC, through its Associate Committee on Scientific Criteria for Environmental Quality, has done more to establish and support work in this area than CASC has been able to do for the past 3 years or is likely to be able to do in the next 5 years with its present approach to funding.

At present the NRC operating grants for agricultural research are distributed primarily through 3 biology grant selection committees - animal biology, plant biology and cell biology - with smaller expenditures through the population biology committee, the earth sciences committee and four engineering committees. Selection of grantees is based primarily on assessment of the applicant and the scientific merit of his proposal. The number and average value of the NRC operating grants in Biology and Agriculture in 1969-70 are shown in Table I, which is reproduced from



Shaw (4). The average operating grant awarded by the Biology Grants Committees is approximately \$8,000.

The NRC also administers large scale projects like IBP. These outline the program framework within which the available funds will be spent. Special emphasis is placed on groups rather than individuals.

TABLE I. Number and Average Value of NRC Operating Grants in Biological and Agricultural Sciences in 1969-70.

<u>Grant Selection Committees</u>	<u>No. of Grants.</u>			<u>Average Grant \$000</u>	
	<u>Total</u>	<u>Agric.</u>	<u>% Agric.</u>	<u>Excluding Agric.</u>	<u>Agric.</u>
Animal Biology	238	86	36	7.9	7.0
Plant Biology	178	80	45	9.6	7.4
Cell Biology and Genetics	251	39	15.5	9.1	8.2
Population Biology	261	27	10	7.6	5.4
Total	928	232	25	8.3	7.2

The Engineering and Earth Sciences Committees also awarded NRC Operating Grants in Agricultural Sciences as follows:

Engineering	859	8	1	8.5	4.2
Earth Sciences	397	17	4.3	7.3	6.5





### (3) The Role of Other Agencies

In addition to the CDA and NRC, several other federal agencies conduct intramural or support extramural research that is directly or indirectly related to agriculture. Among these are the Departments of Industry, Trade and Commerce; Environment; Energy, Mines and Resources; and Indian Affairs and Northern Development. The sub-committee does not have access to data that would permit an estimate of the dollar value of this research. Judging, however, from the percentages of each agency's R & D budget spent on extramural research at universities (see Table II), it would be surprising if the total extramural support for agricultural research at universities from all federal agencies other than CDA and NRC exceeded  $\$0.5 \times 10^6$  per annum.

Provincial governments and industry also conduct and support agricultural research. The sub-committee does not have access to up-to-date comparative figures for all the performing sectors in agricultural research. However, in 1967-68, Smallman et al. (1) calculated that the total expenditure on agricultural R & D in Canada was  $\$75 \times 10^6$  and was distributed between performing sectors in the following way: federal government 53%; provincial governments 10.6%; industry 7.3%; universities 29% (20.8% in agricultural faculties, 8.2% in non-agricultural faculties). It is probably safe to assume that the distribution of expenditures between performing sectors in 1972/73 is not very different from this.



The degree of research support provided to universities (faculties of agriculture) by provincial departments of agriculture varies greatly across Canada. Thus the Ontario Department of Agriculture and Food provides approximately  $\$8 \times 10^6$  per annum for agricultural research, most of which is done at the University of Guelph; the Manitoba Department of Agriculture provides about \$600,000 annually for work in the Faculty of Agriculture at the University of Manitoba; and the Alberta Department of Agriculture through the Alberta Agricultural Research Trust up to \$250,000, allocated as follows: up to \$50,000 for grants not co-supported by industry and up to \$150,000 that is matched dollar for dollar by industry, for research in the Faculty of Agriculture at the University of Alberta. A principle on which the Trust operates is an interesting one, since the whole scheme ensures co-operative effort by the government, the university and industry. In addition, the Alberta Institute of Pedology is supported jointly by the University of Alberta (space provision and consultation time with University staff) and the Federal Government and Provincial Government through the Research Council of Alberta. Each government contributes \$15,000 - \$16,000 per annum and each also provides approximately six professionals, three technicians and one secretary. The Saskatchewan Department of Agriculture provides about \$320,000 (\$80,000 for soil survey and \$250,000 for the crop development centre) and the B.C. Department of Agriculture about \$65,000 per annum for research in their respective faculties of agriculture. Figures for Quebec and the Maritimes are not immediately available to the sub-committee.





#### (4) Recommendations of Science Council Reports

In this section of the report we summarize the main recommendations of Special Study #10 and Science Council Report #12. The authors of Special Study #10 concluded as long ago as 1967 that an Agricultural Research Board should be established to replace CASCC. Conclusions 1 and 2 of Special Study #10 read as follows:

"The Study Group concludes that:

1. Canada should establish an Agricultural Research Board, with representation from all sectors performing or funding agricultural R & D, to advise and recommend to the federal Minister of Agriculture on the conduct and development of an integrated Canadian program.

The Board would:

- (a) maintain a small permanent secretariat supplemented as necessary by experts employed or seconded to undertake special studies;

- (b) function to design and co-ordinate a Canadian policy and program by advice to the Minister on priorities and funding, and through its influence with the performing agencies;

- (c) exercise substantial powers for managing, through grants and contracts, the orderly development of a balanced program within and between the performing agencies.

2. Canada should establish a Renewable Resources Research Council composed of the Chairmen of Research Boards (or bodies equivalent to the Agricultural Research Board) for agriculture; fisheries, forestry, water resources, and



wildlife, to effect co-ordination and to exploit opportunities for collaboration in the scientific management of the nation's renewable resources."

These proposals were modified by the Science Council in Report #12. This report clearly stated that about 90% of the funds for agricultural R & D were controlled by the federal government, principally through CDA; that there was little co-ordination of the agricultural research programs in universities with those in the CDA program. Report #12 therefore recommended the establishment of an Agricultural Research Co-ordinating Council. The relevant recommendations read as follows:

"1. An "Agricultural Research Co-ordinating Council" should be established, with appropriate membership (including a full time chairman) and terms of reference, and the CASCC phased out.

2. A Secretariat should be appointed to provide headquarters staff for the ARCC.

3. The present distribution of institutes and stations should be used as a starting point to organize the "research centres".

4. Contracts should be drawn up by the ARCC with existing research groups at universities and elsewhere; for example, cereal quality program in Manitoba, soil program in Saskatchewan, poultry nutrition at the University of British Columbia, pestology program at Simon Fraser University, animal diseases at Saskatoon and Guelph.

5. A progressive program should be instituted to eliminate or adjust present Research Branch programs and stations, which may be



considered obsolete in the light of university contracts and industry contracts and in the light of the overall review of priorities.

6. Arrangements should be made with provincial governments to establish closer liaison of their extension activities with the research centres in their particular regions.

7. Agreements should be drawn up with universities which will spell out the relationship of each research centre to the surrounding universities.

8. Over a period of time the research presently supported by provincial and other funds should be integrated with the research programs conducted by the "centres" in that particular province.

9. Funding procedures should be amended. The Agricultural Research Co-ordinating Council should be responsible for the allocation of funds to all federal government agricultural research; it should also become the principal source of contract funding for university and industrial research in agriculture. "

#### (5) Comment on University Research

The universities act as creators and repositories of knowledge, which they pass on to their students through teaching at the undergraduate and graduate levels. University expansion in the last 15 years has been the result of increases in student enrolment and has broadly reflected the demand for undergraduate programs in the different branches of learning. What may look to some like uncontrolled expansion has in fact been an often frantic effort to meet these demands, frequently with very limited budgets. It is





thus not surprising that local needs at the undergraduate level have dominated the universities' response. Departmental and faculty budgets have to be justified on the basis of undergraduate, and to a much smaller extent, graduate teaching. Between 80 and 90% of the budgeted funds are allocated for the salaries of teaching and support staff. Of the remaining 10 to 20% virtually no funds are specifically allocated for research in most Canadian universities. Aside from the allocation of space and faculty time, research and graduate training are therefore financed almost entirely by funds obtained in the forms of grants or contracts from outside agencies. It follows that the research that universities, or faculties of agriculture, actually do, depends upon the support individual members of faculty can obtain from the granting agencies. It follows further that the philosophy and objectives of the granting agencies may have a major effect on the universities' research programs and through their effect on their research programs also on university teaching.

Recognition of these considerations is not a strong point of Special Study #10 or of Science Council Report #12.

## CONCLUSIONS AND RECOMMENDATIONS

### (1) Overlap between NRC and CASCC Grants

If it is accepted as a principle that the availability of funds from granting agencies sets the pattern of university research it follows that the NRC has a much greater impact on university research in agriculture than any other federal agency. Including graduate student support in the forms of



scholarships the NRC provides annually about \$2.6 million in support of university based agricultural research - CASCC provides \$800,000. The NRC funds nearly 260 agricultural scientists through the operating grants program at an average level of \$7,000. CASCC's operating grant program funds nearly 150 agricultural scientists at an average level of \$3,767. There is very little co-ordination and a considerable overlap between the two sets of grants. Thus for 1972/73 CASCC awarded operating grants to 146 scientists. 90 of these (62%) also applied to NRC and were awarded grants. 11 others (7%) applied to but were rejected by NRC. 45 (31%) of the CASCC grantees did not apply to NRC - presumably because they felt their projects were not appropriate for NRC support. In other words, CASCC funded only 56 scientists across the country who did not receive support from NRC. If these statements are interpreted as criticisms rather than as simple statements of fact, then both agencies must accept the blame in equal shares.

This sub-committee does not believe that, given the current costs of research, provision of 146 grants at an average level of \$3,767 per annum is an effective contribution to the funding and co-ordinating of research. A more effective approach would be for CASCC to leave the operating grants program entirely to the NRC and to invest all its monies (\$550,000 from operating grants, \$100,000 from special Dean's grants, \$150,000 from the extramural research contract scheme) in extramural contracts. CASCC's \$800,000 would fund 80 contracts each at \$10,000 per annum. There would undoubtedly be protests from the university community if CASCC adopted this approach, but



there can be no question that it would result in a more effective co-ordination of university research in agriculture both within and between universities and CDA than exists at the present time.

The crux of the problem with respect to CASC funds for university research is that they have to compete with the CDA's budget for inhouse research, subsidies, etc. From the university standpoint the NRC's strength as a granting agency lies in the fact that its university support program is established by a separate parliamentary vote and is thus not in competition with the budget for NRC's inhouse research program.

(2) The Science Council Recommendations

This sub-committee regards the main proposals of Special Study #10 given on page 13 as having been outmoded by more recent developments in the Federal government, particularly the establishment of the Department of the Environment, which now includes both Forestry and Fisheries. Of greater relevance and concern are the recommendations of Science Council Report #12, given on pages 14 and 15. In particular, we question whether an Agricultural Research Council as suggested by the Science Council could ever work effectively in practice. The creation of the proposed ARCC implies a degree of control over the research operations of a line department which is not likely to be acceptable to the minister in charge or to his deputies. Provincial governments (Department of Agriculture) and industry are also unlikely to accept the implied degree of control over their funds. We admit, however, that it could be fairly argued that the





Science Council's proposal for an ARCC has not been worked out in sufficient detail to permit a final judgement. The Deans of Agriculture have recently recommended to the Deputy Minister of CDA that an independent committee - the Canadian Agricultural Research Committee - be established outside CASC. This committee would report to the Minister of Agriculture and the deputy minister. The suggested terms of reference are:

- (1) The co-ordination of agricultural research in Canada by reviewing and reporting on the effectiveness of current research programs in all agencies conducting research for agriculture,
- (2) The establishment of priorities for ongoing and new research.

In this connection it is perhaps worth suggesting that Thistle's (3) account on the early relations between the deputy ministers of Mines and Agriculture and the NRC would prove interesting reading for those who believe that the birth and childhood of an ARCC on the Science Council or any other model would be either simple or blissful.

In relation to recommendation #5 of Science Council Report #12, given on pages 14 and 15, we offer the following reassessment. Report #12 makes a case for increasing the relative research inputs by industry, universities and provincial governments. We consider it necessary to emphasize that this re-distribution of effort should be sought through increases in the inputs by these three performing sectors, and not by a decrease in the current research effort of the CDA. The latter is largely



mission-oriented, devoted to the resolution of problems of regional or national importance. This type of research, particularly in "slow-yield" areas demanding long term commitment of resources (e.g. animal breeding) is not attractive to either universities or industry. Thus CDA must be viewed as the logical performer in this area of agricultural R & D.

What is lacking at present is a satisfactory mechanism by which the various agencies conducting agricultural R & D can develop together the background information for setting broad objectives and goals. The program of the Research Branch of CDA is, and has been, under continuous review by the Planning and Co-ordination Unit under the direction of an Assistant Director-General, reporting directly to the Director-General. Adjustments in programs and funding are made in relation to priorities and research being done at universities and in provincial units. In general, priorities are given to those projects with national implications. However, modifications must also be made in the Research Branch program in relation to government objectives and policies. At the university level, decisions on priorities and funding will clearly be affected by local situations, the needs of the individual university or faculty and the provincial governments' views of the universities' roles in agricultural education and research.

### (3) Total Federal Funding for Agricultural R & D

Canada is totally dependent upon scientific agriculture. Perhaps the most important deficiency of the Science Council Reports is their failure to consider the disparity between the total funds available for



agricultural R & D and the importance of the industry in Canada. Data developed by the Agricultural Economics Research Council indicates that the food system core (production, food processing industries, tobacco, natural and synthetic input materials and institutional food trade) contributes about 28% of Canada's Gross National Product. Primary Agriculture contributes 5-6% of the Gross Domestic Product, a figure that has been stable since 1957. Industries directly related to agriculture contribute 8% and indirectly related industries contribute 6% to the G.N.P. Thus the total food system contributes 42% (28 + 8 + 6) to the G.N.P. For every dollar sale of food, the return to the economy will vary from a high of 6.1 to a low of 4.5. The variation in multipliers depends on the region in which the dollar is spent. and the particular commodity. Thus research to support or increase industries in the food system will provide a good return to the economy.

The Ministry of State for Science and Technology estimates Canada's total expenditure on science in 1972-73 as  $\$1.09 \times 10^9$  (6). Of this  $\$701.8 \times 10^6$  ( $\$640.8 \times 10^6$  in natural sciences and  $\$60.9 \times 10^6$  in human sciences) were assigned to R & D and  $\$380.5 \times 10^6$  to related scientific activities, including data collection, scientific information and scholarship programs ( $\$239.6 \times 10^6$  in natural sciences,  $\$140.8 \times 10^6$  in human sciences). The total ( $\$1.09 \times 10^9$ ) represents only 1.3% of the G.N.P., with Canada ranking 7th among the nations of the world in expenditures on science, being outranked by the U.S.A. (2.8%), the U.K. (2.2%), the Netherlands, France, Germany and Japan.





The percentages of total expenditures for R & D in the natural sciences ( $\$640.8 \times 10^6$ ) assigned to the various federal government departments or agencies are given in Table II, together with the percentages of each agency's R & D budget spent to support work in universities and other non-profit institutions:

TABLE II

<u>Agency</u>	<u>% of federal expenditure on R &amp; D</u>	<u>% of agency's R &amp; D budget spent for extramural R &amp; D in education and non-profit institutions</u>
NRC	18.0	50.5
I, T and C	15.6	0.89
DOE	15.1	3.5
Agriculture	10.4	1.2
AEC	10.2	1.0
National Defence	8.3	6.3
MRC	5.6	93.0
EMR	5.0	3.1
Others	11.8	39.9
<hr/>	<hr/>	<hr/>
All	100*	20.6**

\*Total R & D  $\$640.8 \times 10^6$

\*\*Total extramural R & D  $\$148.3 \times 10^6$

Derived from Table 5 in (6).

The figure of 10% for CDA (actually  $\$67 \times 10^6$ ) does not represent all the funds allocated in agricultural R & D, since it does not include intra and extramural research conducted or supported by NRC, I, T and C, DOE and other agencies which could readily be identified as agricultural. The salient features of the expenditures for 1972-73 are:



- (1) More than 13 departments or agencies are involved.
- (2) One of the major departments (DOE) is of very recent origin (1969-70) and has absorbed all the budgets for Fisheries and Forestry, along with substantial parts of the budgets of EMR, Transport and other agencies.
- (3) Agriculture has not increased as rapidly as some other agencies, so that although its budget for R & D increased by 2.3 fold its share of the total R & D budget has fallen from approximately 13% in 1963-64 to 10% in 1972-73.
- (4) Total expenditures on scientific activities by the Department of Agriculture at  $\$69.9 \times 10^6$  represent only 7.9% of total federal expenditures ( $\$880.5 \times 10^6$ ). This is less than 1/5th of the contributions (42%) of the total food system to the G.N.P. Agriculture's R & D budget at  $\$67 \times 10^6$  is only 6% of total federal expenditures on scientific activities, roughly equivalent to the contribution (5-6%) of primary agriculture to the G.N.P.

There can be no doubt that the creation of new departments or agencies has a major effect on the funding for others. This would be unavoidable even under financial circumstances which were less restrictive than those that have prevailed over the past several years. But if funds for agriculture and biology are considered to be inadequate relative to the whole effort in Canadian R & D, then the onus for improvement of this situation properly lies with those who seek to undertake research and



development in these areas. They and they alone must bear responsibility for convincing the general public of the relevance and urgency of these claims. Equally important they must convince senior administrators at university, provincial and federal levels of the imperative need for forward planning, for ventures into the frontiers of research, and in short, receptivity to the principle that research investments in agriculture and biology are investments in the future of Canada. Granting bodies (e.g. NRC) cannot be expected to document and promote these philosophies without the active, independent support of individual scientists.

#### (4) Sub-Committee's Recommendations

On the principle that he who pays the piper calls the tune, and recognizing NRC's experience and expertise, the sub-committee considers that the NRC is in an excellent position to effect a greater degree of co-ordination and rationalization of university based research in agriculture and to help build centres of strength in different areas in the different faculties. Moreover, we believe that this could be done without any infringement of the 'right' of the individual scientists to conduct research in the area of his choice. The NRC is also in an excellent position to promote the involvement of industry in agricultural research, both in government and the universities. With these points in mind we offer the following recommendations:

1. The National Research Council of Canada, in consultation with the Canada Department of Agriculture, should establish a committee on agricultural research. The committee should include representatives of the universities, industry and the CDA. It should:





- (1) Make a thorough study of the research topics in agriculture supported by the NRC, CASCC and other agencies in the last 3 years.
  - (2) Examine the 'overlap' between the operating grants schemes of CDA and NRC.
  - (3) Assess the quality of the research being conducted by the universities in the component disciplines of agriculture.
  - (4) Identify areas in which insufficient or inadequate research is being conducted, bearing in mind (a) basic research that underpins agriculture (e.g. in photosynthesis and nitrogen fixation), (b) the need for agricultural faculties to be supported in their efforts to develop research on the environmental and ecological aspects of agriculture in addition to production agriculture.
  - (5) Identify areas in which research involving industry or industrial application would be particularly useful in relation to the 'food system'.
  - (6) Provide guidelines to prospective grantees based on the conclusions reached in relation to Nos. 1 to 5.
  - (7) Promote a better working relationship between the various agencies funding university research in agriculture with respect to the kinds of research to be supported by each of them.
2. The NRC should take the initiative in encouraging major grant applications from universities (faculties of agriculture) where the potential for the development of excellence exists. This involves the provision of guidelines to indicate areas of high priority or areas in which insufficient research is being carried out.



3. The NRC should give careful consideration to augmenting, where necessary, the agricultural expertise on existing grant selection committees. Individual scientists should, however, still have the option of directing their applications to one of the existing grants committees.

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R. L. Taylor



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